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54 Dishwashing Machine

The invention concerns a significant improvement of conventional dishwashing machines for dishes and pots/pans with at least two vertically separated dish baskets and with spray systems for the dishwashing fluids located below the baskets. The option of partitioning the dishwashing chamber allows for optimal use of detergent, water and energy, thus achieving optimal use in specific applications for small loads of dishes just as well as for large loads. The invention also proposes the economically optimal production of such dishwashing machines by producing identical dishwashing chamber sections, which may be combined vertically in any number of units to yield a dishwashing machine of lesser or larger volume, which can then always be operated optimally in one or more dishwashing chamber sections.

Patent Claims:

1. Dishwashing machine for dishes and pots/pans with selectable and independently operating wash and dry cycles, with a heatable reservoir for the dishwashing liquid situated on the floor of the dishwashing chamber with storage reservoirs to hold various dishwashing fluids, and with spray systems that spray the dishes either from a fixed or a rotating position, characterized by having a dishwashing chamber (2), which can be separated into at least two smaller chambers (2<sub>1</sub>, 2<sub>2</sub>) stacked above each other, each with spray systems (3, 3<sub>1</sub>) stacked above each other for dish baskets stacked above each other associated with each spray system and/or by allowing for separate control of the cleaning process in one or more sub-chambers of the entire washing chamber space of the dishwashing machine.
2. Dishwashing machine according to Claim 1, characterized by having a barrier to subdivide the dishwashing chamber (2<sub>1</sub>, 2<sub>2</sub>) that consists of a partition (4), which may be inserted between the separate spray systems (3, 3<sub>1</sub>).
3. Dishwashing machine according to Claim 2, characterized by having the partition (4) inserted to subdivide the dishwashing chamber (2<sub>1</sub>, 2<sub>2</sub>) linked to control switches, which are activated by the partition and by which the dishwashing process may be switched off in the separated dishwashing chamber (2<sub>1</sub>) or in the chambers above the inserted partition (4).
4. Dishwashing machine according to Claims 1 to 3, characterized by a dishwashing process that scales back in proportion to the separated dishwashing chambers (2<sub>1</sub>) switched off by insertion of the partition (4), where this proportion refers to the amount of water, dishwashing load, possibly the number of heating elements turned on, the heat produced and the like.
5. Dishwashing machine according to Claims 1 to 4, characterized by having a lock-out valve (16) in the supply lines (10) for the spray liquid to each spray system (3) in the various dishwashing chambers (2<sub>1</sub>, 2<sub>2</sub>).
6. Dishwashing machine according to Claims 1 to 5, characterized by having the separable dishwashing chamber (2) consist of one or more housing components (5), each with an internal and separate spray system linked to the spray liquid supply line, where these housing components may be stacked above each other.
7. Dishwashing machine according to Claim 6, characterized by the possibility that the separate housing component (5) can be mounted on a separate support unit (7) with liquid supply and drain, dishwashing liquid sump, heating and detergent pumps, also possibly air drying apparatus.

8. Dishwashing machine according to Claim 6, characterized by having a separate topping unit (6) on the upper push-on connection of the separate housing component (5).
9. Dishwashing machine according to Claim 6, characterized by having supply lines (10) to spray systems (9) that may be connected at the upper and lower push-on connections (11, 12) in each housing component and the support unit (7) to form a closed supply circuit for the dishwashing liquid.
10. Dishwashing machine according to Claims 6 to 9, characterized by having double walls in housing components (5), where these components may plug into the support unit (7) and the topping unit (6) as well as additional housing components (5) stacked above each other.
11. Dishwashing machine according to Claims 6 to 10, characterized by having the lower push-on connections (11) of housing components (5) and the topping unit (6) insert into the corresponding lower component (5) to its interior in a waterproof manner.
12. Dishwashing machine according to Claims 6 to 10, characterized by having rubber or plastic elements (17) that are inserted into the gap between the upper (11) and lower connectors (12) of housing components (5) as well as to the support unit to close the gap between housing components (5) and make it waterproof.
13. Dishwashing machine according to Claims 6 to 12, characterized by having a door (8) on the front of dishwashing chamber (2) that extends vertically across one or more housing components (5).
14. Dishwashing machine according to Claims 6 to 13, characterized by having ventilation channels (14) that extend for the full height of housing components (5, 5<sub>1</sub>) to provide flow of fresh air and exhaust.
15. Dishwashing machine according to Claims 6 to 14, characterized by having at least one closeable vent (15) to the ventilation channels in each housing component (5).
16. Dishwashing machine according to Claims 1 to 15, characterized by having the fresh air and exhaust channels (14) embodied to include a heat exchanger (23).
17. Dishwashing machine according to Claims 1 to 16, characterized by having the potential to heat or pre-heat the fresh air via the reservoir of dishwashing liquid.

18. Dishwashing machine according to Claims 1 to 17,  
characterized by  
a unit width for insertion, including the insertion tolerance, of 0.50 m.

### Dishwashing Machine

The invention concerns a dishwashing machine for dishes and pots/pans with selectable and independently operating wash and dry cycles, with a heatable reservoir for the dishwashing liquid situated on the floor of the dishwashing chamber with storage reservoirs to hold various dishwashing fluids, and with spray systems that spray the dishes either from a fixed or a rotating position.

The known dishwashing machines of this type still have substantial disadvantages, despite the known resource-saving control programs for the required amount of water and the associated energy consumption for heating the dishwashing liquid. These disadvantages derive from the fixed volume of the dishwashing chamber, which can be utilized optimally only if the interior volume is completely filled with dirty dishes. However, the volume of dirty dishes varies widely in each household over time, such that the volume of the dishwashing chamber is usually too large for a household with just a few persons. If the dishwashing machine is to be used optimally in such an instance, the purchase of additional dishes is required, while the cleaning of dishes accumulated over several days requires more intensive wash cycles and various dishwashing fluids, which in turn lead to a shorter useful life of the dishes.

On the other hand, the manufacturer of dishwashing machines needs to base production on an average chamber volume in order to produce machines at low cost.

Proposals have been made to use smaller size dishwashing machines for smaller households. However, these did not become commonplace, because the required technical features are often unsatisfactory for the smaller machines or because the technical requirements to produce such smaller dishwashing machines are no less than for the production of larger machines. On the other hand, there remains a demand for dishwashing machines with smaller dishwashing volume and correspondingly reduced energy requirements, water use and use of detergents. Also, the usual width of dishwashing machines is seriously disadvantageous, because they cannot be used for older or existing kitchen counters with a 0.50 m width.

A previous proposal (DE - AS 14 53 070) proposes to subdivide the dishwashing chamber into at least two separate chambers, where different or identical dishwashing programs may optionally be run independently or simultaneously. However, such a dishwashing machine is technically excessively complicated and requires more space, which smaller households cannot provide in any case. Moreover, such a machine does not satisfy the objective of an economically operating small dishwashing machine.

It is the objective of the present invention first to improve the known dishwashing machines with the known and proven dishwashing technology in such a way as to overcome the overwhelming disadvantages described above and to provide a better match with the various demands in a household, thereby to allow for a substantial reduction in the use of energy, water and detergent.

Second, an additional objective of the invention is the provision of a dishwashing machine with the requirements described above for small to large dishwashing volumes, which can be produced economically from standardized components.

To meet the objectives, a dishwashing machine of the type described above is proposed, where this invention is characterized by a dishwashing chamber, which can be subdivided into

smaller chambers stacked above each other, each with spray systems stacked above each other for dish baskets located above each other associated with each spray system, and/or by allowing for separate control of the cleaning process in one or more small chambers of the entire washing chamber space of the dishwashing machine.

A dishwashing machine equipped with these characteristics guarantees an optimal match with the varying needs of the household, with the number of dishes in an optimal relationship to the use of energy, water and detergent. For example, a household dishwashing machine of the usual size with two spray systems stacked above each other may be subdivided by the insertion of a partition into two smaller sub-chambers stacked above each other, where the dishwashing process is restricted to the lower sub-chamber by means of appropriate programming controls. This makes it feasible to wash a smaller amount of dishes at once in the lower sub-chamber economically, without having to wait until the entire chamber is filled with dirty dishes, which are then more difficult to clean.

In addition, the small household does not need an excessive number of dishes. However, if more dirty dishes accumulate, the partition can be removed, at which time the dishwashing program switches automatically to the larger volume and the entire dishwashing chamber can be used fully as usual.

Other advantageous characteristics are shown in Claims 2 to 18.

Selected embodiment examples are intended to illustrate the invention by means of drawings. These show the following:

Fig. 1 a separable dishwashing chamber of a dishwashing machine with two spray systems,

Fig. 2 a dishwashing machine with housing components that are connected by push-on connections,

Fig. 3 an embodiment example of the connection and gasket of the housing components,

Fig. 4 a further embodiment example according to Fig. 3.

Fig. 1 shows a schematic drawing of dishwashing machine 1, which contains a dishwashing chamber 2 in the usual fashion, with two rotating spray systems 3, 3<sub>1</sub>. Push-in dish baskets are situated above the individual spray arms 3 in the usual fashion; they are not shown in this drawing. The front door is also not shown in this drawing, because it may be produced by known methods, possibly with reservoirs for detergents and control switches. The division of the entire washing chamber 2 is achieved by insertion of a partition 4 below the top spray system 3, which yields two separate dishwashing chambers 2<sub>1</sub> and 2<sub>2</sub>. There are contacts or non-contact switch components along the plane of insertion of partition 4, which may be embodied as a holder 9 of any type, where these contacts turn off spray system 3 above partition 4 by, for example, switching on a solenoid valve in the supply line of the upper spray system 3 and possibly switching on a correspondingly reduced control program. Thus, the lower dishwashing chamber 2<sub>2</sub> may be optimally used by itself for smaller dish loads, which will avoid a prolonged drying of food residue on the dishes during the otherwise longer collection period to fill the entire dishwashing chamber 2. If dishwashing sub-chamber 2<sub>2</sub> is too small for the accumulated dish load, partition 4 may be removed by a simple pull, which makes the entire chamber 2 and the full dishwashing program available again immediately.

Fig. 2 shows an additional particularly advantageous embodiment for commercial production of dishwashing machines of the functionality described above. The particular advantage in this embodiment lies in the direct economies of production of single separate housing components that are suitable for use in small dishwashing machines with a single housing component 5 or in larger dishwashing machines, such as with three or four vertically stacked housing components 5. Depending on the current demand, a dishwashing machine with four housing components 5, which yield four sub-chambers, may activate a single sub-chamber, or alternatively two, three or all four sub-chambers. Such an arrangement is particularly advantageous for applications such as restaurants, where the dishwashing load varies significantly over time.

Fig. 2 illustrates such a dishwashing machine with two housing components 5 and 5<sub>1</sub>. Each housing component 5 and 5<sub>1</sub> contains a rotating spray system 3, 3<sub>1</sub>. Supply lines 10 of the spray systems 3, 3<sub>1</sub> can be connected along the lower connector 11 and the upper connector 12 of housing components 5, 5<sub>1</sub> by means of known pipe connectors 13. A valve, such as a solenoid valve 16 in supply line 10, is incorporated below spray system 3 and above pipe connector 13 to shut off the spray liquid in order to shut off the top spray system 3.

The lower housing component 5<sub>1</sub> is mounted on a separate support unit 7, which contains liquid supply and drain lines, detergent sump, heater and detergent pumps, possibly also an air drying system and switches. A separate topping unit 6 may be mounted on the top of the upper housing component 5 to provide the top to the dishwashing chamber 2. Housing components 5, 5<sub>1</sub> are best produced with double walls, as previously known, and are either shaped such that the lower push-on connectors of lower connectors 11 of the upper housing component 5 fit into the interior of lower housing component 5<sub>1</sub> in a water-proof manner or the unmodified lower connectors 11 and upper connectors 12 are simply connected with a push-on rubber or plastic component, as is shown in Fig. 3 and 4.

Door 8 to close dishwashing chamber 2 in the direction of the arrow may extend in height across one or more housing components 5 and may house switching and control units for the dishwashing programs, as is common now.

The rubber or plastic component in Fig. 3 is best shaped as a block and, if needed, may contain an opening to match the air channels 14 included between inner wall 18 and outer wall 19. Rubber or plastic component 17 contains gasket flanges 20, which extend to the outside; these flanges separate lower connectors 11 and upper connectors 12. However, it is also feasible that gasket flanges 20 contain an elastic lip 21 on at least the interior wall 18; this lip is directed downward in order to deflect the dishwashing liquid better and to prevent moisture from reaching channel 14.

A further advantageous embodiment of the invention contains a manually closable opening 15 in each housing component 5, 5<sub>1</sub> in order to assure an optimal air flow either in one or in more housing components. For example, it is conceivable that openings 15 for fresh air in the lower component and outlets 15 for exhaust in the uppermost component be opened to access air channels 14, while the outlets 15 in the middle section of dishwashing chamber 2 remain closed.

It is also advantageous to design the fresh air and exhaust channels as heat exchangers 23, where the fresh air also may be pre-heated via the reservoir of the dishwashing liquid.